Appl. No.: 10/632,034
Amdt. dated 05/06/2005
Reply to Office action of February 8, 2005

Amendments to the Claims:

1. (Original) A method of nondestructively determining a property of a porous sample having a mass, said method comprising:

evacuating a first vessel to a sub-atmospheric pressure;

establishing a test pressure in a second vessel having the sample disposed therein, the test pressure being greater than the sub-atmospheric pressure;

equalizing the pressures of the first and second vessels by opening a valve mechanism operably engaged between the first and second vessels, each of the first and second vessels thereby experiencing a pressure change, the pressure change in the second vessel exhibiting an initial pressure drop followed by a transition to an equalization pressure on a pressure vs. time curve;

determining an envelope volume of the sample from a minimum pressure attained by the second vessel upon initial opening of the valve mechanism, the minimum pressure being related to the initial pressure drop; and

determining an envelope density of the sample as a quotient of the mass and the envelope volume of the sample.

2. (Original) A method according to Claim 1 further comprising determining an absolute volume of the sample from the equalization pressure of the second vessel.

3. (Original) A method according to Claim 2 further comprising determining an absolute density of the sample as a quotient of the mass and the absolute volume of the sample.

4. (Original) A method according to Claim 3 wherein the sample comprises an asphalt paving mix and the method further comprises determining a theoretical maximum specific gravity (Gmm) of the asphalt paving mix sample as a quotient of the absolute density of the sample and a density of water at about 25°C.

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5. (Original) A method according to Claim 1 wherein the sample is selected from the group consisting of a soil sample and an aggregate sample and the method further comprises determining a bulk specific gravity (Gsb) of the sample as a quotient of the envelope density of the sample and a density of water at about 25°C.

6. (Original) A method according to Claim 3 wherein the sample is selected from the group consisting of a soil sample and an aggregate sample and the method further comprises determining an absolute specific gravity (Gsa) of the sample as a quotient of the absolute density of the sample and a density of water at about 25°C.

7. (Original) A method according to Claim 1 further comprising purging the first and second vessels using at least one purge cycle, each purge cycle comprising evacuating the first and second vessels and then filling the first and second vessels with a substantially inert gas.

8. (Original) A method according to Claim 1 wherein evacuating the first vessel further comprises evacuating the first vessel to a pressure of about 20 Torr.

9. (Original) A method according to Claim 1 wherein establishing the test pressure in the second vessel further comprises establishing a pressure of about 700 Torr in the second vessel.

10. (Original) A method according to Claim 1 wherein determining the envelope volume of the sample further comprises determining the envelope volume of the sample from the minimum pressure, the minimum pressure being determined according to an analysis comprising modeling the transition between the initial pressure drop and the equalization pressure on the pressure vs. time curve so as to produce a best-fit equation and then determining, using the equation, the minimum pressure attained by the second vessel upon initial opening of the valve mechanism.

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11. (Original) A method according to Claim 1 further comprising:

determining the envelope volume of the sample from the minimum pressure, the
minimum pressure being determined according to an analysis comprising
modeling the transition between the initial pressure drop and the equalization
pressure on the pressure vs. time curve so as to produce a best-fit equation and
then determining, using the equation, the minimum pressure attained by the
second vessel upon initial opening of the valve mechanism;

determining a pressure vs. time curve for a substantially nonabsorbent specimen having
an envelope volume substantially the same as the sample envelope volume by
substituting the substantially nonabsorbent specimen for the sample in the second
vessel and then equalizing the pressures between the first and second vessels; and

comparing the pressure vs. time curves for the substantially nonabsorbent specimen to the
pressure vs. time curve for the sample so as to determine the relative absorption of
the sample.

12. (Original) A system for nondestructively determining a property of a porous sample
having a mass, said system comprising:

a first vessel capable of being evacuated to a sub-atmospheric pressure;

a second vessel having the sample disposed therein and capable of being established at a
test pressure, the test pressure being greater than the sub-atmospheric pressure;

a valve mechanism operably engaged between the first and second vessels and configured
such that opening of the valve mechanism allows the pressures of the first and
second vessels to equalize to an equalization pressure; and

a monitoring device configured to determine a pressure change in the second vessel when
the valve mechanism is opened, the pressure change being indicative of a
minimum pressure attained by the second vessel upon initial opening of the valve
mechanism, the minimum pressure being related to an envelope volume, a
quotient of the mass and the envelope volume of the sample thereby providing an
envelope density of the sample.

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13. (Original) A system according to Claim 12 wherein the monitoring device is further configured to determine an absolute volume of the sample from the equalization pressure of the second vessel, a quotient of the mass and the absolute volume of the sample thereby providing an absolute density of the sample.

14. (Original) A system according to Claim 12 further comprising a purging mechanism configured to purge the first and second vessels using at least one purge cycle, each purge cycle comprising evacuating the first and second vessels and then filling the first and second vessels with a substantially inert gas.

15. (Original) A system according to Claim 14 wherein the purging mechanism is further configured to evacuate the first vessel to a pressure of about 20 Torr.

16. (Original) A system according to Claim 14 wherein the purging mechanism is further configured to establish the test pressure of about 700 Torr in the second vessel.

17. (Original) A system according to Claim 12 wherein the first vessel and the second vessel define a volume ratio of about 2:5.

18. (Original) A system according to Claim 12 wherein at least the first vessel is comprised of aluminum.

19. (Original) A system according to Claim 12 further comprising a computer device operably engaged with at least one of the second vessel and the monitoring device and configured to model the transition between the initial pressure drop and the equalization pressure on the pressure vs. time curve so as to produce a best-fit equation, determine, using the equation, the minimum pressure attained by the second vessel upon initial opening of the valve mechanism, and determine the envelope volume of the sample from the minimum pressure.

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20. (Original) A system according to Claim 12 further comprising a computer device operably engaged with at least one of the second vessel and the monitoring device and configured to:

model the transition between the initial pressure drop and the equalization pressure on the pressure vs. time curve so as to produce a best-fit equation, determine, using the equation, the minimum pressure attained by the second vessel upon initial opening of the valve mechanism, and determine the envelope volume of the sample from the minimum pressure;

determine a pressure vs. time curve for a substantially nonabsorbent specimen having an envelope volume substantially the same as the sample envelope volume, substituted for the sample in the second vessel, upon equalization of the pressures between the first and second vessels; and

compare the pressure vs. time curves for the substantially nonabsorbent specimen to the pressure vs. time curve for the sample so as to determine the relative absorption of the sample.

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